

WHAT IS CLAIMED IS:

- 1 1. A dual current-perpendicular-to-plane (CPP) GMR sensor, comprising:
2 a first magnetic shield formed of an electrically conductive and magnetically
3 shielding material;
4 a second magnetic shield formed of an electrically conductive and magnetically
5 shielding material, the first and the second magnetic shields disposed to define a read gap
6 therebetween;
7 a spin valve structure disposed between the first and second magnetic shields, the
8 spin valve structure including a dual spin valve arrangement, the dual spin valve
9 arrangement having a top and bottom spin self-pinned layer and a free ferromagnetic
10 layers disposed therebetween; and
11 a biasing layer disposed proximate the top self-pinned layer in a passive region
12 for pinning the top self-pinned layer.

- 1 2. The dual CPP GMR sensor of claim 1 further comprising:
2 a hard bias layer disposed proximate the bottom self-pinned layer in a passive
3 region for biasing the bottom self-pinned layer;
4 a first metal oxide layer disposed between the biasing layer and the hard bias layer
5 for providing an insulation layer to the hard bias layer; and
6 a second metal oxide layer formed above the biasing layer.

1 3. The dual CPP GMR sensor of claim 2 further comprising a second metal
2 oxide layer formed above the biasing layer.

1 4. The dual CPP GMR sensor of claim 3, wherein the metal oxide layers
2 further comprises NiO.

1 5. The dual CPP GMR sensor of claim 3 further comprises a ferromagnetic
2 layer disposed over the second metal oxide layer and the self-pinned layer, wherein the
3 second metal oxide layer removes exchange coupling to the hard bias layer.

1 6. The dual CPP GMR sensor of claim 5 further comprising a Ta layer
2 formed between the ferromagnetic layer and the second shield.

1 7. The dual CPP GMR sensor of claim 6, wherein the ferromagnetic layer
2 comprises NiFe.

1 8. The dual CPP GMR sensor of claim 1 further comprising a first and
2 second metal oxide layer formed under and above the biasing layer.

1 9. The dual CPP GMR sensor of claim 8, wherein the metal oxide layers
2 further comprises NiO.

1 10. The dual CPP GMR sensor of claim 9 further comprises a ferromagnetic
2 layer disposed below the second shield and over the second metal oxide layer and the
3 self-pinned layer, wherein the second metal oxide layer removes exchange coupling to
4 the hard bias layer.

1 11. The dual CPP GMR sensor of claim 10 further comprising a Ta layer
2 formed between the ferromagnetic layer and the second shield.

1 12. The dual CPP GMR sensor of claim 10, wherein the ferromagnetic layer
2 comprises NiFe.

1 13. The dual CPP GMR sensor of claim 1, wherein the first and second shields
2 function as electrodes for supplying current to the spin valve structure.

1 14. The dual CPP GMR sensor of claim 1, wherein the biasing layer
2 comprises a layer of $\alpha\text{-Fe}_2\text{O}_3$, the layer of $\alpha\text{-Fe}_2\text{O}_3$ pinning the top self-pinned
3 layer.

1 15. The dual CPP GMR sensor of claim 1, wherein the layer of $\alpha\text{-Fe}_2\text{O}_3$
2 pins the top portion of the top self-pinned layer by providing higher coercivity (H_C) to the
3 top self-pinned layer.

1 16. A magnetic storage system, comprising:
2 a magnetic storage medium having a plurality of tracks for recording of data; and
3 a dual CPP GMR sensor maintained in a closely spaced position relative to the
4 magnetic storage medium during relative motion between the magnetic transducer and
5 the magnetic storage medium, the dual CPP GMR sensor further comprising:
6 a first magnetic shield formed of an electrically conductive and
7 magnetically shielding material;
8 a second magnetic shield formed of an electrically conductive and
9 magnetically shielding material, the first and the second magnetic shields disposed to
10 define a read gap therebetween;
11 a spin valve structure disposed between the first and second magnetic
12 shields, the spin valve structure including a dual spin valve arrangement, the dual spin
13 valve arrangement having a top and bottom spin self-pinned layer and a free
14 ferromagnetic layers disposed therebetween; and
15 a biasing layer disposed proximate the top self-pinned layer in a passive
16 region for pinning the top self-pinned layer.

1 17. The magnetic storage system of claim 16, wherein the CPP GMR sensor
2 further comprises:

3 a hard bias layer disposed proximate the bottom self-pinned layer in a passive
4 region for biasing the bottom self-pinned layer;

5 a first metal oxide layer disposed between the biasing layer and the hard bias layer
6 for providing an insulation layer to the hard bias layer; and

7 a second metal oxide layer formed above the biasing layer.

1 18. The magnetic storage system of claim 17, wherein the CPP GMR sensor
2 further comprises a second metal oxide layer formed above the biasing layer.

1 19. The magnetic storage system of claim 18, wherein the metal oxide layers
2 further comprises NiO.

1 20. The magnetic storage system of claim 18, wherein the CPP GMR sensor
2 further comprises a ferromagnetic layer disposed over the second metal oxide layer and
3 the self-pinned layer, wherein the second metal oxide layer removes exchange coupling
4 to the hard bias layer.

1 21. The magnetic storage system of claim 20, wherein the CPP GMR sensor
2 further comprises a Ta layer formed between the ferromagnetic layer and the second
3 shield.

1 22. The magnetic storage system of claim 21, wherein the ferromagnetic layer
2 comprises NiFe.

1 23. The magnetic storage system of claim 16, wherein the CPP GMR sensor
2 further comprises a first and second metal oxide layer formed under and above the
3 biasing layer.

1 24. The magnetic storage system of claim 23, wherein the metal oxide layers
2 further comprises NiO.

1 25. The magnetic storage system of claim 24, wherein the CPP GMR sensor
2 further comprises further comprises a ferromagnetic layer disposed below the second
3 shield and over the second metal oxide layer and the self-pinned layer, wherein the
4 second metal oxide layer removes exchange coupling to the hard bias layer.

1 26. The magnetic storage system of claim 25, wherein the CPP GMR sensor
2 further comprises a Ta layer formed between the ferromagnetic layer and the second
3 shield.

1 27. The magnetic storage system of claim 25, wherein the ferromagnetic layer
2 comprises NiFe.

1 28. The magnetic storage system of claim 16, wherein the first and second
2 shields function as electrodes for supplying current to the spin valve structure.

1 29. The magnetic storage system of claim 16, wherein the biasing layer
2 comprises a layer of $\alpha\text{-Fe}_2\text{O}_3$, the layer of $\alpha\text{-Fe}_2\text{O}_3$ pinning the top self-pinned
3 layer.

1 30. The magnetic storage system of claim 16, wherein the layer of
2 $\alpha\text{-Fe}_2\text{O}_3$ pins the top portion of the top self-pinned layer by providing higher
3 coercivity (H_C) to the top self-pinned layer.

1 31. A method for providing a dual current-perpendicular-to-plane (CPP) GMR
2 sensor with improved top pinning, comprising:

3 forming a first magnetic shield of an electrically conductive and magnetically
4 shielding material;

5 forming a second magnetic shield of an electrically conductive and magnetically
6 shielding material, the first and the second magnetic shields disposed to define a read gap
7 therebetween;

8 forming a spin valve structure between the first and second magnetic shields, the
9 spin valve structure including a dual spin valve arrangement, the dual spin valve
10 arrangement having a top and bottom spin self-pinned layer and a free ferromagnetic
11 layers disposed therebetween; and

12 forming a biasing layer disposed proximate the top self-pinned layer in a passive
13 region for pinning the top self-pinned layer.

1 32. The method of claim 31 further comprising:
2 forming a hard bias layer proximate the bottom self-pinned layer in a passive
3 region for biasing the bottom self-pinned layer;
4 forming a first metal oxide layer between the biasing layer and the hard bias layer
5 for providing an insulation layer to the hard bias layer; and
6 forming a second metal oxide layer above the biasing layer.

1 33. The method of claim 2 further comprising forming a second metal oxide
2 layer above the biasing layer.

1 34. The method of claim 3 further comprises forming a ferromagnetic layer
2 over the second metal oxide layer and the self-pinned layer, wherein the second metal
3 oxide layer removes exchange coupling to the hard bias layer.

1 35. The method of claim 5 further comprising forming a Ta layer between the
2 ferromagnetic layer and the second shield.